VƏHŞİ VƏ ƏHLİLƏŞMİŞ HEYVANLARIN SARS-COV-2 KORONAVİRUSUN YARANMASI VƏ YOLUXMASINDA ROLU

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Xülasə Məqalədə heyvanların koronavirusları barəsində ədəbi mənbələr araşdırılır, onların patogenlik dərəcəsi, virusun gələcək zamanlarda yayılmasında rolu araşdırılır. Alimlərin dünya üzərində birgə tədqiqatları SARS-CoV-2 koronavirusun yarasa və yırtıcı heyvanların, xüsusilə pişikkimilər fəsiləsinin nümayəndələrinin koronavirusları ilə filogenetik əlaqələrini müəyyən etməyə imkan yaradıb. Ancaq dəvələrdən insana keçən Yaxın Şərq atipik pnevmoniyasının yaranması iri və xırda buynuzlu heyvanların təsərrüfatlarda saxlanmasında təhlükəsizlik tədbirlərinin həyata keçirməsinə xüsusi diqqət tələb edir.

Açar sözlər Koronaviruslar, heyvan təbiətli rezervuarı, yaranması, yoluxması.

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THE ROLE OF WILD AND DOMESTICATED ANIMALS IN THE ORIGIN AND TRANSMISSION OF THE CORONAVIRUS SARS-COV-2

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Abstract The article provides literature data on animal coronaviruses, their degree of pathogenicity, and the possible role of domestic animals and livestock in the further spread of the COVİD 19 virus. Joint researches by scientists all around the world have established that the coronavirus SARS-CoV-2 has a close phylogenetic relationship with the coronaviruses of bats and carnivores, especially with the representatives of Felidae family (cat-like mammals). However, the case of Middle Eastern SARS transmitted by camels requires special attention to biological safety measures when keeping livestock in farms.

Key words Coronaviruses, animal reservoir, origin, transmission.

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РОЛЬ ДИКИХ И ОДОМАШНЕННЫХ ЖИВОТНЫХ В ПРОИСХОЖДЕНИИ И РАСПРОСТРАНЕНИИ КОРОНАВИРУСА SARS-COV-2

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Аннотация В статье приведены литературные данные по коронавирусам животных, степени их патогенности и возможной роли домашних и сельскохозяйственных животных в дальшейшем распространении вируса. Совместные исследования ученых по всему миру позволили установить, что коронавирус SARS-CoV-2 имеет тесную филогенетическую связь с коронавирусами летучих мышей и хищных животных, особенно с представителями семейства кошачьих. Однако случай ближневосточной атипичной пневмонии, передавшейся от верблюдов, требует особого внимания к мерам безопасности при содержании крупного и мелкого скота в фермах.

Ключевые слова Коронавирусы, резервуар животной природы, происхождение, передача.

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Introduction

The world is experiencing anxious days. The borders are closed, shopping centers and cultural institutions ceased operations. Ten million people have already been infected (European Center for Disease Prevention and Control, 28.06.2020), the number of infected people continues to increase rapidly. The reasons for all above-mentioned facts are the SARS-CoV-2 virus (Severe acute respiratory syndrome coronavirus 2). The virus causes affected organism common (fever, cough, shortness of breath, fatigue, loss of smell and taste) and specific symptoms. While the majority of cases result in mild symptoms, some progress to multi-organ failure due to acute respiratory distress syndrome possibly precipitated by cytokine storm (Murphy et al.: 2020, pp. 1499-1500; Qing Ye, Bili Wang, Jianhua Mao: 2020, pp. 608-609).

In this short review, we will try to analyze the genesis of this pathogen, its connection with other coronaviruses and the ability of emerging and re-emerging in wild and domesticated animals.

CoVs in animals

Coronaviruses (CoVs) are single-stranded RNA viruses that cause diseases in mammals and birds. They belong to the Coronaviridae family, Nidovirales order, Pisuviricota phylum (ICTV Taxonomy, 2020). Prominent club-shaped projections form a kind of solar corona in their surface, clearly visible under the electron microscope. Thereby, the systematic name of Coronaviridae family derives from these specific structures in virus surface (Almeida et al.: 1968, p. 650; McIntosh: 1974, p. 99).

All human coronaviruses (HCoVs) are the typical zoonoses (Decaroa, Lorusso: 2020, pp. 1-2; Ye Zi-Wei et al.: 2020, pp. 1686-1697). The primary hosts of HCoVs inhabits in wild and domestic animals. Since the 1930th, coronaviruses have been recognized as dangerous infectious agent (McIntosh: 1974, pp. 86-88). The first dangerous representative of CoVs, Avian Coronavirus (IBV) was described in 1960 (Estola: 1970, pp. 330-336).

Then the human coronaviruses HCoV-229E and HCoV-OC43 were discovered (Zi-Wei Ye et al .: 2020, pp. 1687-1688). Since the discovery of the first representative of the coronavirus family, many HCoVs have been discovered, including HCoVs from birds, even-toed ungulates (domestic pigs), ruminants, equines, bats, carnivores, rodents and insectivores (Decaro, Lorusso: 2020, pp. 3-13).

There relatively harmless and extremely dangerous coronavirus strains were detected. For example, Murine Coronavirus (MCoV, MHV specifically) causes a high mortality, especially among colonies of laboratory mice. Another strain of Murine Coronavirus, SDAV (Sialodacryoadenitis virus) has high morbidity and tropism for the salivary, lachrymal and harderian glands (NCBI Taxonomy Browser, 2020; Otto, Franklin, Clifford: 2015, pp. 177-178).

Most Feline Coronavirus (FCoV)-infected cats are healthy or display only a mild enteritis. Up to 12% of infected animals may succumb to feline infectious peritonitis with high level of mortality. FCoV can survive for 7 weeks in a dry environment and can be transmitted indirectly (Addie et al.: 2009, 594-595).

Finally, we need to clarify the veterinary aspect of the origin of SARS CoV 2. A study conducted by Chinese scientists demonstrated that the estimated primary reservoir for this coronavirus was the horseshoe bats (Zhou et al.: 2020, pp. 270-272). Apparently, new virus got to the man through intermediate hosts, pangolins, sold in the wet markets in Wuhan city. This mechanism of the new virus is very similar to the SARS CoV epidemic in 2002 in Guangdong

province, China. The intermediate host for SARS Cov was the palm civets (Hui et al .: 2020, p. 264).

Since its discovery in the early 1970s, a variety of pathological conditions in domestic animals were attributed to coronavirus infections. Some of the CoVs already adapted to humans. They can cause mild diseases in patients with weak immune systems. However, in the case of the severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome coronavirus (MERS-CoV), these CoVs didn't adapt to humans and were found mainly in animal reservoirs (Ludovice, 2020). Whereas the bat-to-human transmission of SARS-CoV was likely mediated by palm civets, humans probably acquired MERS-CoV from dromedary camels (Li, Du: 2019, p. 1).

Transmission SARS CoV 2 from animal to human: New Facts

Since the beginning of the COVID-19 epidemic, infection of domestic and farm animals with SARS CoV 2 virus has been assessed as unlikely (COVID-19 and farmed and domestic animals, 2020; ANSES, 2020). Meanwhile, in November 2019, Connor Reed, a teacher in Wuhan, gave the first information about the infection of a kitten with a fatal outcome (Reed, 2019). Unfortunately, this message was not taken seriously. Finally, in March 2020, the fact of the transmission of SARS CoV 2 from man to animal was confirmed. A Pomeranian dog died in Hong Kong, being infected by its owners (Aly Song, 2020; Lung N., 2020).

Soon, Chinese scientists investigated the susceptibility of ferrets and other animals in close contact with humans to SARS CoV-2. They found that this coronavirus replicates poorly in dogs, pigs, chickens, and ducks. Unfortunately, ferrets and cats are permissive to infection. Also, cats are susceptible to airborne transmission (Shi et al.: 2020, pp. 1016-1020).

Information about the infection of domestic cats was confirmed experimentally as a result of the joint work of American and Japanese scientists (Halfmann et al.: 2020, pp. 1-2).

Not one farm animal (excluding minks) case has been reported to date, which would have significant implications in food safety and biohazard. Nevertheless, the S protein nucleotide sequence of the SARS-CoV-2 virus isolated in domestic animals and humans is identical (AVMA, 2020; Hernandez: 2020, p. 1). Coronaviruses infecting humans and carnivores are phylogenetically closely related (Leroya, Gouilhb, Brugere-Picouxc: in press).

Thus, we have to admit: SARS CoV 2, in principle, can pass from humans to animals. The reverse transmission has not yet been registered — but not excluded. And this can lead to even greater growth of the epidemic.

Conclusion

Thus, the presented short review allows us to draw the following conclusions. The appearance of SARS CoV 2 was predictable: it already had many strains similar in structure and life cycle among other CoVs. Failure in veterinary regulations in wet Chinese markets has led to a spontaneous mutation of the ancestor virus and generated a new and aggressive HCoV.

Thus, it is very important to observe biohazard rules in research laboratories, not to keep animals clumped, and not to allow direct contact with them by service personnel.

Despite the fact that no cases of infection with the virus of cattle and other farm animals have been detected, possibility for this undesirable scenario still persists. Farm workers must wear personal protective facilities and observe safety measures. Owners of infected pets should not contact their companions to prevent infection and possible transmission to other people.

The outbreak of the coronavirus pandemic has taken place on a large scale. But it can be stopped only with the joint efforts of medical workers and veterinary services.

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